FLEAS.

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Plate xvii.

To most people fleas are merely a nuisance, to be destroyed on every possible occasion; they are, however, of great interest, both from a scientific and an economic aspect. It is my intention to present here a few of the most interesting features as regards the distribution of the species of fleas found in Australia, and to indicate some of the numerous gaps in the knowledge of our native species.

The Common Flea (*Pulex irritans*) is generally regarded as essentially a human species; it is however found on other animals, in many cases so rarely as to make its occurrence an accidental one, but in others its presence appears to be normal. Bishopp states that it is such a common parasite of pigs that it might well be called the Hog Flea. Other investigators have found that it probably develops usually on the Hedge-hog.

The human Flea is world wide in its distribution, but varies in prevalence in different localities. Probably it is universally distributed in Australia, but information is wanted on this point.

The Cat and Dog Fleas (*Ctenocephalus felis* and *canis*) occur both on cats and dogs, and are also of universal distribution. Both appear to be widely distributed in Australia; recently I received two fleas brought back from Central Australia, both were specimens of the Cat Flea. The Hon. Dr. Strong, of New Guinea, on another occasion sent some specimens of fleas taken from a native village 300 miles up the Fly River, which had only once before been visited by white men or civilised natives. They proved to be Dog Fleas. The Dog Flea is also common in the Solomon Islands.

Three other species of fleas have been introduced into Australia with the introduction of rats and mice. These are of great economic importance, as one of them is the flea that is responsible for the spread of plague. This species, generally known as the Indian Rat Flea (*Xenopsylla cheopis*) occurs both on the Brown or Sewer Rat (*Rattus norvegicus*) and on the Black Rat (*Rattus rattus*). It is, however, a flea of tropical and subtropical countries, and its distribution in Australia has been by no means properly worked out. It is present in Sydney throughout the year, and in summer it is the predominant species on rats, reaching its maximal seasonal abundance in February. It is also present in Western Australia and in Queensland, but information is wanting in regard to the Southern States. *X. cheopis* has been recorded from Melbourne and Port Adelaide; most of the records are however from shipping. No information is available as to the prevalence of this species among the shore rats. Mr. Nicholls informs me that the species appears to be absent from Tasmania, or at least from Hobart. The knowledge of its distribution is of importance on account of the relation of the species to the spread of plague, and the immunity which the Southern States have hitherto enjoyed from this disease may well be due to the absence of *Xenopsylla cheopis*. A second species of *Xenopsylla* has recently been received, taken from a native rat (*Leporillus jonesi*) found on Franklin Island, in the Nuyt's Archipelago, by Prof. Wood Jones. This has not yet been positively identified, but it appears to belong to an African species *X. nubicus*; this identification has been confirmed by Dr. K. Jordan. If so, its

occurrence in an out of the way place in Australia is of extreme interest and suggests the need for further investigation; quite possibly it will be found to replace *X. cheopis* in the adjacent portion of South Australia. The other rat flea of importance, the so-called European Rat Flea (*Ceratophyllus fasciatus*) is common in the southern portion of Australia. In Sydney it is fairly abundant on rats during the cooler months, but relatively uncommon in the height of the summer. In Europe it has been stated to be a vector of plague, but it is doubtful if it exercises such a rôle here, or at least anything more than a very subsidiary one.

The third rat flea is the Mouse Flea (*Ctenopsylla musculi*) which appears to be of relatively little importance. It does not appear to bite human beings, and, although I have found plague bacilli in these fleas, the species can be of little importance in the spread of the disease except from rat to rat.

I have dealt so far with introduced species of fleas. There are, however, a fair number of native species already known, and these are of greater interest to the Australian scientist. Unfortunately our knowledge of them is practically restricted to the adults, and in most cases to a bare record of the hosts upon which they were taken. Many parts of the Continent have not been searched for these parasites, and, while undoubtedly many of the species are widespread, the information available so far indicates that there are many species so closely allied to each other that they may almost be regarded as geographical races.

As regards their hosts, the majority have been found on marsupials or rodents, but do not appear to be necessarily always found on the one host; for instance, *Stephanocircus dasyuri* is found on both marsupials and rodents, while *Echidnophaga myrmecobii* is found on a large number of animals.

No records appear to exist of fleas from the larger marsupials, with the exception of the tree kangaroo (*Dendrolagus*). This is probably connected with the habits of these animals. On the other hand the smaller marsupials such as Bandicoots, Tiger Cats, and the like are often heavily infested with fleas. Many of these animals will harbour two or even more species of fleas.

Fleas may also be taken in the breeding nests of the smaller marsupials and rodents, and it is in these situations that the larval and pupal stages are doubtless passed.

The family *Pulicidae* is represented in Australia by some 12 genera. The dominant group is probably that comprised by *Pygiopsylla* and its allies. These are the Australian representatives of the old world genus *Ceratophyllus* and some of our species were originally described under that genus. Quite recently the genus *Pygiopsylla,* in which all the species were contained, has been split by Jordan and Rothschild into 5 genera, *Pygiopsylla* being restricted to species from Australia and New Guinea. In this genus 9 species are now listed. *P. hilli,* the type species, is a Western Australian form, only known from a single specimen taken from *Bettongia penicillata.* In the Eastern coastal districts of Australia and Tasmania two species—*hoplia* and *congrua*—occur commonly on the smaller marsupials and rodents: there is no restriction to any particular species as host and both species may inhabit the same host. One of them, *P. hoplia,* has even been taken from the Platypus in Tasmania. *P. zethi* has a similar distribution from Tasmania to Sydney, being also found on the same class of animals; the male of this species is unknown.

In the case of *P. solida* from Queensland from a rodent, only a single male is known. The remaining 4 species from a second group in the genus, one—*laciniosus*—is from New Guinea, the rest are Australian; all have been taken from rodents and in the case of *P. rainbowi* also from a bandicoot. The species as far as known show a marked geographical distribution, *P. rainbowi* being re-

corded from New South Wales, *P. gravis* from Victoria, and *P. colossus* from Tasmania, the last species being known only from a single female.

Of the genera split off from *Pygiopsylla,* one—*Stivalius*—includes all the extra-Australasian species formerly placed in *Pygiopsylla.* 5 species are also recorded from New Guinea, and one, *S. rectus,* from North Queensland from a "Grey Scrub Rat."

Choristopsylla contains 3 species, *ochi, thomasi* and *tristis*: the genus is apparently restricted to the South Eastern portion of the Continent, *C. ochi* is recorded from Victoria and New South Wales, and *C. tristis* from Victoria, while the habitat of *C. thomasi* is unknown. It is noteworthy that unlike *Pygiopsylla,* which is found only on ground mammals, the species of *Choristopsylla* are confined to arboreal marsupials, *C. ochi* being found on the Common Opossum (*Trichosurus vulpecula*), *C. thomasi* on the Pigmy Flying Opossum (*Acrobates pygmaeus*) and *C. tristis* on the Yellow-bellied Flying Opossum (*Petaurus australis*) and the Pigmy Flying Opossum.

Bradiopsylla contains but one species—*B. echidnae* which occurs in Tasmania, Victoria and New South Wales, and is restricted to the Echidna (*Tachyglossus aculeatus*).

The remaining genus of the group—*Acanthopsylla*—comprises 4 species, *A. rothschildi,* the type species, being further subdivided into 3 geographical subspecies—*rothschildi, nereis* and *victoriana* from New South Wales and Queensland, Clarke Island (Bass Strait), and Victoria respectively; the first subspecies occurs on *Dasyurus viverrinus, Phascologale flavipes* and the Paddymelon (*Macropus thetides*); the second on *Potorous tridactylus,* and the third on *Phascologale swainsoni. A. woodwardi* from Western Australia is only known from the female and the host is unrecorded. *A. saphes* from Victoria was taken from a Native Cat (*Dasyurus*). *A. pavida* from Queensland and Northern New South Wales has been taken from a large number of hosts, mostly arboreal, and including the Tree Kangaroo (*Dendrolagus lumholtzi*), Ringtail Opossum (*Pseudochirus* spp.) and Flying Opossum (*Petaurus breviceps*). There is also a record of a specimen having been taken from the Paddymelon (*Macropus thetides*).

Close to the *Pygiopsylla* group but differing in its large triangular 8th tergite is another genus—*Uropsylla*—which contains but one species, *U. tasmanicus,* described from Tasmania from *Dasyurus viverrinus.*

Australia possesses representatives of two genera of non-combed eyed *Siphonaptera—Lycopsylla* and *Parapsyllus.*

Lycopsylla is a somewhat aberrant genus containing one species, *L. novus,* described from the Wombat (*Phascolomys mitchelli*).

Parapsyllus contains the flea (*P. australiacus*) found on the Little Penguin (*Eudyptula minor*). The type came from Western Australia, but specimens are known from Tasmania, Flinders Island and New South Wales.

The genus *Stephanocircus* contains possibly the most distinct of all our Australian fleas, though it is nearly allied to the South American genus, *Craneopsylla,* the members of which were originally described under *Stephanocircus.* Five species of the genus are known, the first described and best known—*S. dasyuri*—occurs commonly on the Native and Tiger Cats and on Bandicoots, its range extending from South Queensland into Tasmania. It has also been recorded from Rats (*R. velutinus*).

Of the remaining species of the genus, *S. simsoni* occurs in Tasmania on *Dasyurus viverrinus* and *Rattus velutinus*; *S. jervisi* in Victoria on *Phascologale swainsoni*; *S. pectinipes* in Victoria on *Rattus assimilis*; while *S. concinnus* was described from Queensland from *Rattus* sp. The genus is characterised by the curious helmet on the head.

The next genus *Stephanopsylla* also possesses a helmet, though of somewhat different shape, and the unique species *S. thomasi* was originally described as a *Stephanocircus*. The species was found on a specimen of *Pseudomys forculinus* from Barrow Island, North-west Australia.

Macropsylla is another extraordinary Australian genus which contains but one species, *M. hercules*. It is the largest of all our Australian fleas, and occurs on various species of rodents in Tasmania, New South Wales and South Australia. The genus possesses combs on the abdominal segments.

The family *Ceratopsyllidae* contains the hat fleas of which two species only have been recorded from Australia, one—*Ischnopsyllus caminae* from Perth taken from a hat, and the other *C. reductum* from Melbourne from *Vespertilio macropus*. The latter species is however regarded by Baker as merely a variety of *C. caminae*.

The third family of *Siphonaptera*—the *Sarcopsyllidae*, contains the Chigoes or Jiggers and the Stick-tight Fleas.

The genus *Echidnophaga* was erected by Olliff to contain a curious flea—*E. ambulans*—found on the Echidna. The genus has however since been found to include a number of species found in various parts of the world and occurring on many different animals, so that the generic name is not an appropriate one.

Like the rest of the family, the species of *Echidnophaga* are characterised by the reduced thoracic segments, by the relatively weak legs, and the serrated mandibles. These modifications are related to the mode of life of these insects. Having found its host, the flea proceeds to settle down on a suitable spot, inserting its rostrum deeply and not moving away: this habit has given rise to the name Stick-tight Flea.

Undoubtedly the species of greatest economic importance is *E. gallinacea*, the Stick-tight Flea of poultry. Originally described from Ceylon, this species is found over the greater part of the world, and has been responsible for much damage to poultry, particularly in the United States of America. About two years ago the species made its appearance as a pest of poultry in Western Australia, and now is widely distributed over the State, attacking poultry, dogs, horses, rats and even man. Although only recently causing trouble, the species has been present in Western Australia since 1914 at the least, as Mr. Clark has sent me specimens taken in that year on *Peragale lagotis* in the Geraldton district. The Stick-tight Flea is gradually spreading eastwards; I have seen specimens from rabbits from the Eucla District and from a dog and a child from Ooldea on the East-west railway line.

The introduction of this pest into the eastern States would be a dire calamity for poultry farmers, and the importation of birds from Western Australia should be subject to rigorous quarantine.

Another species that requires watching is the closely allied *Echidnophaga myrmecobii*. This was described from specimens taken from a number of native animals, including *Trichosurus vulpecula, Bettongia lesueuri, Myrmecobius fasciatus, Peragale lagotis* and *Diemenia superciliosa*. The specimens from *Trichosurus* were from New South Wales and Victoria, the remainder from Western Australia. Recently the species has been found attacking the introduced rabbit in New South Wales and the introduced rat in South Australia and Sydney.

Specimens have also been received from Prof: Wood Jones, taken on Franklin Island from *Leporillus jonesi*. The species is so closely allied to *E. gallinacea* that a critical examination of the tarsal joints is necessary to separate them; *E. gallinacea* has two apical ventral bristles on the fifth metatarsal joint of all the legs, and *E. myrmecobii* a single one in this situation.

Jordan and Rothschild express the opinion that *E. myrmecobii* may be merely

a geographical race of *E. gallinacea*. That it may also become a farmyard pest is not beyond the bounds of probability.

Of the remaining species *E. ambulans* and *E. liopus* both occur on the Echidna (*Tachyglossus aculeatus*), *E. liopus* appearing to be the western representative of *E. ambulans*; *E. macronychia* is described from Western Australia, occurring on *Bettongia lesueurii*.

This concludes the review of the described Australian species, the types are mainly in England and of comparatively few species are there examples in Australian collections. The number of species (33) is small, considering the vast area of Australia and the peculiar marsupial fauna; doubtless many more species await discovery.

Excepting for a limited area in North Queensland fleas are practically unrecorded for Northern Australia. The list of hosts could in all probability also be greatly amplified; the bats, for instance, have not been at all thoroughly examined. Nests of marsupials and rodents might with profit be searched for these insects.

From the public health aspect a knowledge of our fleas is of importance. Information is lacking as to whether native species will attack man or be able to act as vectors of such a disease as plague. That marsupials are not immune from plague was shown in a former Sydney outbreak when a number of these animals died from plague in the old Moore Park Zoological Gardens. Possibly, or, indeed, probably, fleas may act as the vectors of many of the haemo-parasites of our native animals. There is a further field for research in this direction. The possibility of the native Stick-tight Fleas developing into pests has already been mentioned.

For the purpose of gaining further knowledge of the geographical distribution of our Australian species, specimens would be welcomed from any part of Australia. These may be forwarded in small tubes in alcohol, and should be accompanied by a small slip of paper inserted in the tube with the name of the animal from which each example was taken, with the date and locality written in ordinary pencil.